

ifm electronic



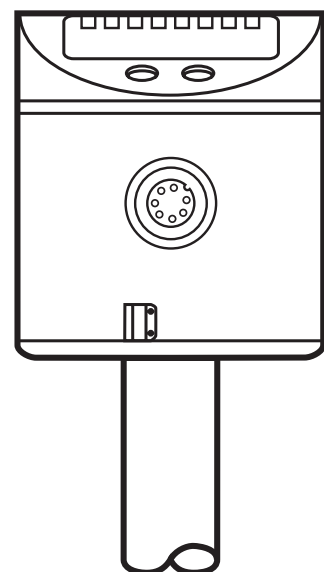
Operating instructions
Electronic level and
temperature sensor

efector160[®]

LT80

UK

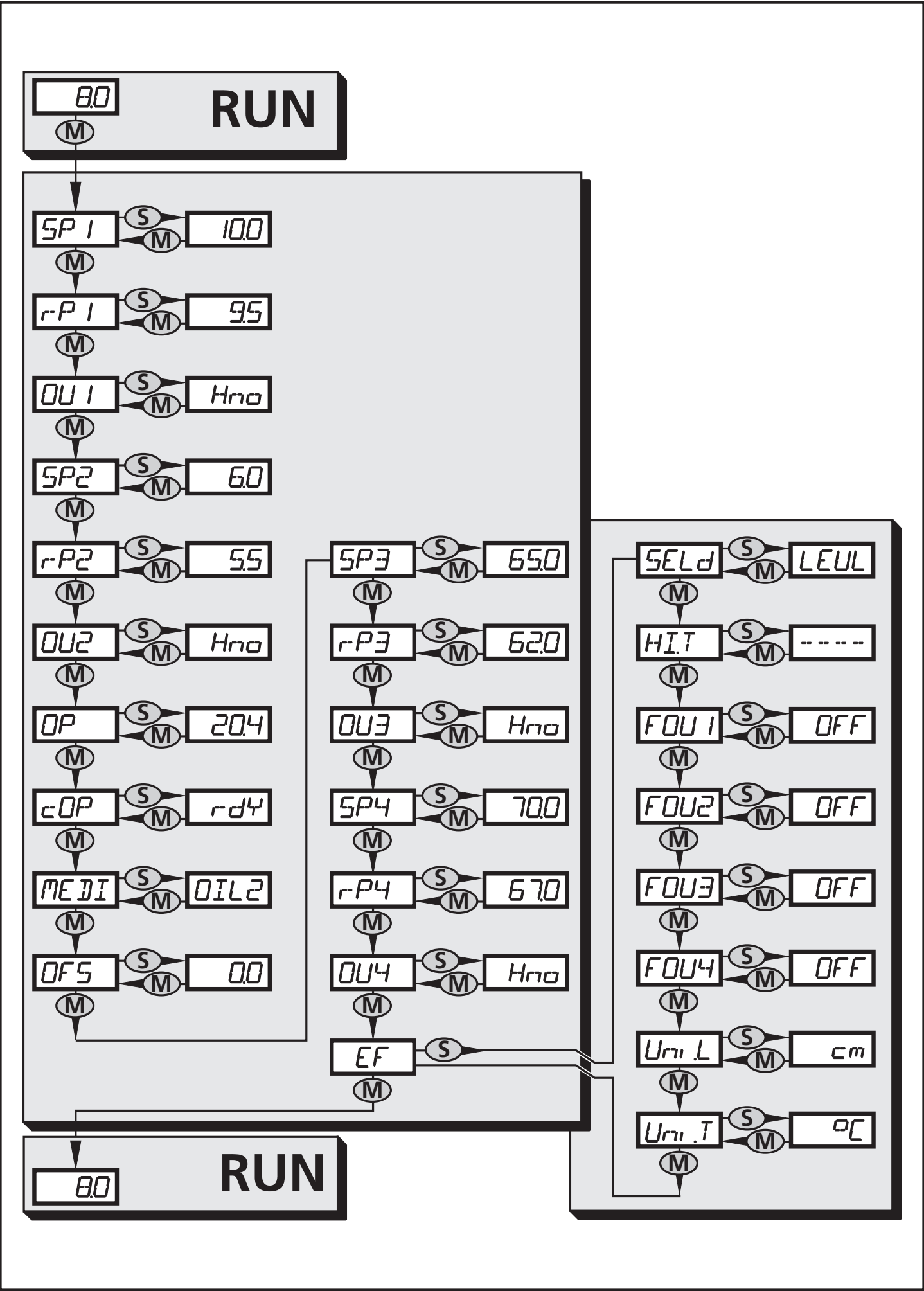
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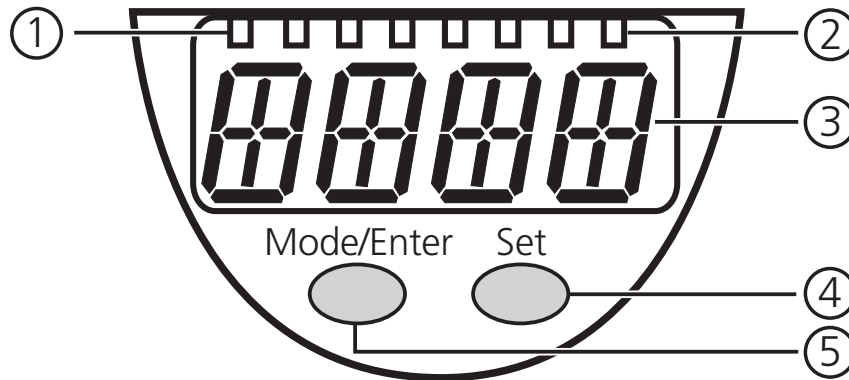
Contents

1 Menu structure.....	3
2 Controls and indicating elements.....	4
3 Function and features.....	5
3.1 Application: hydraulic systems.....	5
3.2 Reference point OP	6
3.3 Further functions.....	6
4 Mounting.....	7
5 Electrical connection.....	9
6 Programming	10
6.1 Selection of the display unit	10
6.2 Setting to the medium.....	11
6.3 Setting of the offset value	12
6.4 Setting of the switching parameters	12
6.5 Selection of the displayed measuring unit.....	16
6.6 Setting of the output response in case of a fault	16
6.7 Adjustment of the reference element OP.....	17
7 Set-up / operation	19
7.1 Operation and fault indication.....	19
7.2 Changeover between level and temperature indication	20
7.3 Read / reset maximum value memory temperature	20
7.4 Read the set parameter values	20
7.5 Output response in different operating states.....	20
8 Technical data.....	21
9 Scale drawing	22

1 Menu structure



2 Controls and indicating elements



1	4 x LED green	Lighting LED = set display unit: -LED 1 = level in cm. -LED 2 = level in inch. -LED 3 = temperature in °C. -LED 4 = temperature in °F.
2	4 x LED yellow	Switching status indication; lights if the respective output is switched. -OUT1 / OUT2 = level. -OUT3 / OUT4 = temperature.
3	4-digit alphanumeric display	- Indication of the current level. - Indication of the current temperature. - Indication of the parameters and parameter values.
4	Set pushbutton	- Setting of the parameter values (scrolling by holding pressed; incremental by pressing briefly). - Change of the display unit in the Run mode.
5	Mode / Enter pushbutton	Selection of the parameters and menu points, acknowledgement of the parameter values.

3 Function and features

3.1 Application: hydraulic systems.

- The unit is designed only for use in oils (mineral or synthetic) or in media with similar characteristics.
- It is not suitable for extremely conductive or adhering media, granulates, bulk materials, acids, alkalis or any aqueous media; it is not suitable for food and electroplating applications.

The unit monitors 2 process values:

- Level
Continuous measured value detection using the capacitive measuring principle (evaluation of the dielectric constant of the medium).
- Temperature of the medium
Measured value detection using the Pt element at the lower end of the probe.

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Display	<ul style="list-style-type: none"> • Current level in cm or inch. • Current medium temperature in °C or °F. The display unit is defined by programming (→ 6.3). The measuring unit (level / temperature) can be changed in the Run mode temporarily (briefly press the “Set” pushbutton, the corresponding LED lights). • Warning in case of overflow (“FULL” and the current level are indicated alternately if the set reference point OP is reached).
Signal output	<p>Outputs 1 and 2 (level)</p> <ul style="list-style-type: none"> • 2 switching signals OUT1 / OUT2 with adjustable switch points (SP1 / SP2) and reset points (rP1 / rP2). • Warning in case of overflow (both outputs switch according to the configuration if the set reference point OP is reached: ON for the output function Hno or Fnc, OFF for the output function Hnc or Fno). <p>Outputs 3 and 4 (temperature)</p> <ul style="list-style-type: none"> • 2 switching signals OUT3 / OUT4 with adjustable switch points (SP3 / SP4) and reset points (rP3 / rP4). <p>The switching function can be set for each output:</p> <ul style="list-style-type: none"> - hysteresis / NO (Hno) - hysteresis / NC (Hnc) - window function / NO (Fno) - window function / NC (Fnc).

3.2 Reference point OP

(OP = overflow protection point)

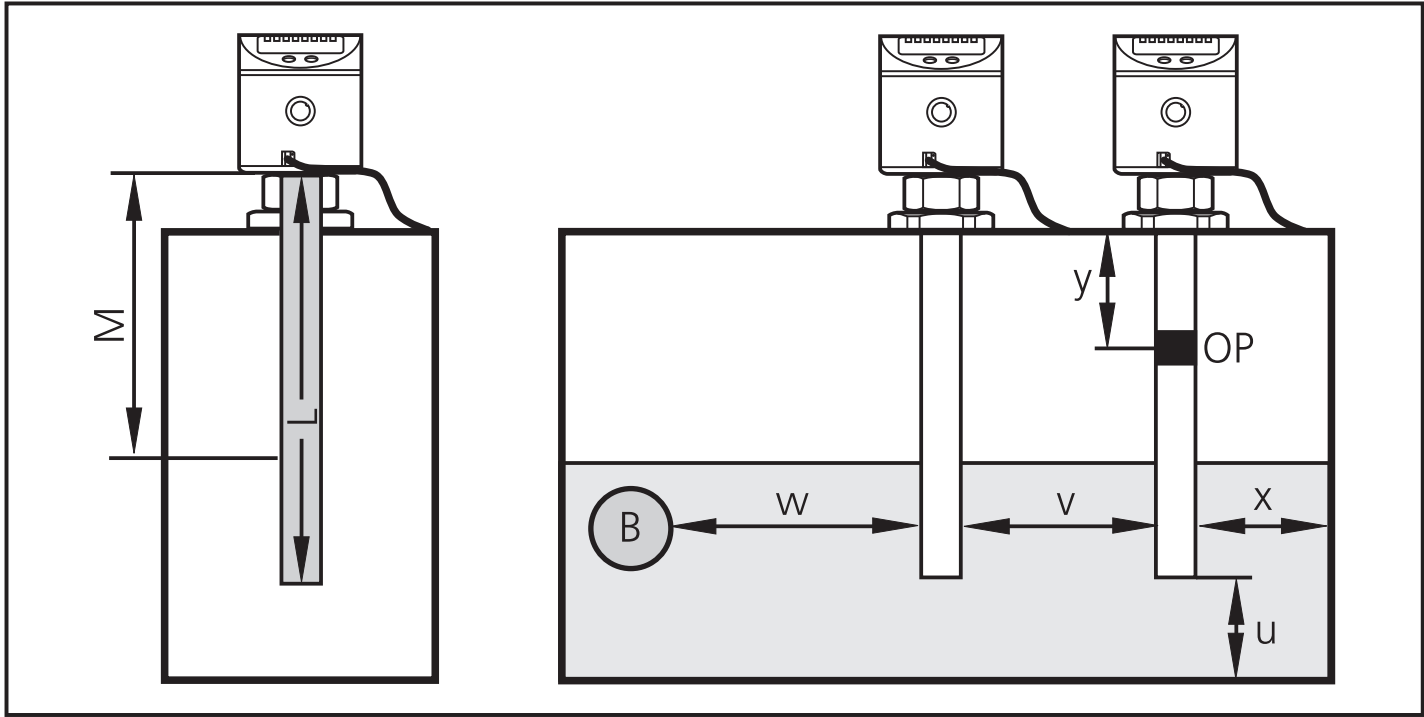
A measuring segment of the probe is defined as reference point (→ 6.4). It fulfils 2 functions:

- Adaptation to the application / Reliable start-up
For the automatic adjustment the OP segment generates a measured signal. The software checks it and adjusts the unit optimally to the tank to be monitored.
In case of a successful adjustment the display indicates rdy. The unit is ready for operation. If the adjustment cannot be made, an error message is given (→ 7.1).
- Overflow protection
During the operation the OP segment is monitored continuously and serves as a reference point for an independent overflow protection.
The position of the OP segment is programmable. The set value refers to the middle of the measuring segment. Typically, OP already reacts when the OP segment is reached.
The overflow switch point OP has a fixed hysteresis of a few millimetres.
The response time when switching on the overflow alarm: typ. 450 ms, max. 720 ms.
OP is the maximum limit of the measuring range. The switch points are always below OP. If OP is shifted to a value \leq SPx, the position of SPx is also shifted downward.
Note: The outputs OUT1 and OUT2 switch when the set switch points are reached, but at the latest with reaching OP (overflow protection).

3.3 Further functions

- The zone between tank bottom and lower edge of the measuring probe can be entered as offset value (OFS; → 6.3). Thus display and switch points refer to the real level.
- The sensor can be adjusted to the medium used (→ 6.2). A water layer at the bottom of a tank filled with oil does not influence the level measurement.
- Wave movements of the medium are smoothed
- The response of the outputs in case of a fault is adjustable (→ 6.6).
- The unit has a maximum value memory for temperature. The stored value can be indicated and deleted via pushbutton.

4 Mounting



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	LT8022		LT8023		LT8024	
	cm	inch	cm	inch	cm	inch
L (probe length)	26.4	10.4	47.2	18.6	72.8	28.7
M (mounting zone)	14	5.5	23	9.1	36	14.2

- Fix the mounting elements within the “M” area.
- Mounting elements must be fixed above the measuring segment OP and at a minimum distance to OP (see value y, measured to the middle of the segment).
- Minimum distances between the probe and the tank wall, metallic objects in the tank (B), tank bottom and other level sensors must be adhered to. The distances x, y and w depend on the medium set (MEDI).

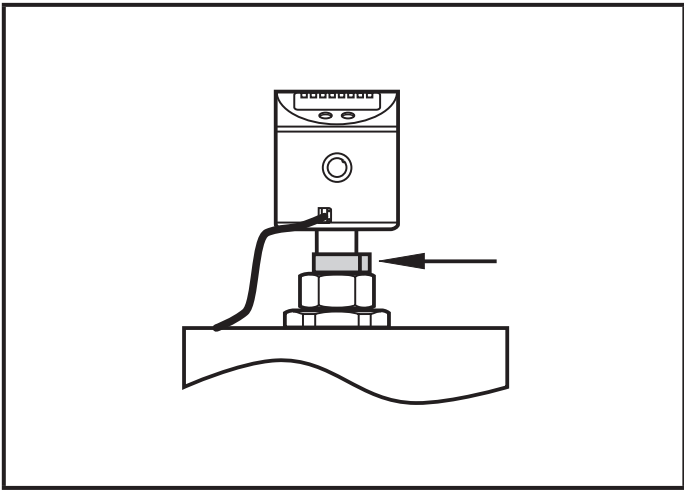
	MEDI = OIL1		MEDI = OIL2	
	cm	inch	cm	inch
x	3.0	1.2	4.0	1.6
y (LT8022)	3.5	1.4	4.5	1.8
y (LT8023)	5.5	2.2	6.5	2.6
y (LT8024)	7.0	2.8	8.0	3.2
u	1.0	0.4	1.0	0.4
v	4.5	1.8	4.5	1.8
w	5.0	2.0	6.0	2.4

- For mounting in plastic pipes / plastic tanks the inside (pipe) diameter must be min. 12 cm (4.8 inch).
- For mounting in metal pipes the inside pipe diameter (d) must be at least:

	MEDI = OIL1		MEDI = OIL2	
	cm	inch	cm	inch
d	6.0	2.4	12.0	4.8

Marking of the installation height:

Fix the set installation height with the supplied stainless steel tube clip. If the sensor is removed from the fixture for maintenance reasons, the clip serves as a limit stop when remounting the sensor. Thus an inadvertent maladjustment of the sensor is excluded. This is in particular necessary for the correct function of the overflow protection.



The clip is fitted using common nipper pliers. Ensure a correct fit. To remove the clip, it must be destroyed.

Mounting accessories:

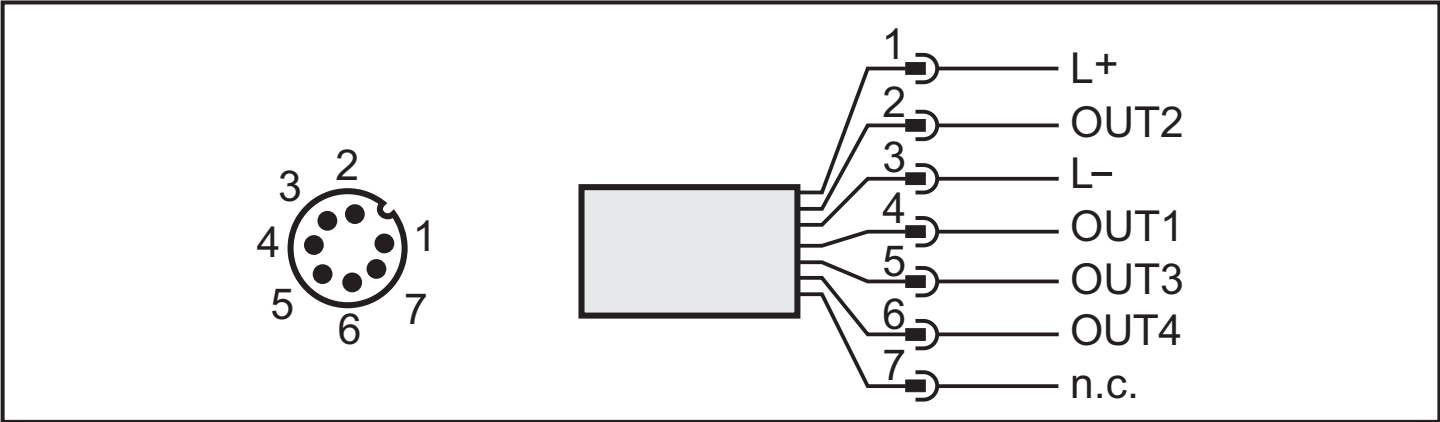
Flange plate 73 - 90, aluminium / stainless steel	order no. E43001
Welding adapter, stainless steel	order no. E43002
Mounting adapter G3/4, stainless steel	order no. E43003
Mounting adapter G1, stainless steel	order no. E43004
Flange plate 100 - 125, aluminium / stainless steel	order no. E43005
Flange plate 65 - 80, aluminium / stainless steel	order no. E43006
Flange plate 54 - 52 x 52, aluminium / stainless steel	order no. E43007

5 Electrical connection



The unit must be connected by a suitably qualified electrician.
The national and international regulations for the installation of electrical equipment must be observed.
Voltage supply according to EN50178, SELV, PELV / “supply class 2” to cULus.

Disconnect power before connecting the unit as follows:



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Pin / connection	core colours: ifm sockets	core colours: sockets following DIN 47100
1 L+	brown	white
2 OUT2 (level)	white	brown
3 L-	blue	green
4 OUT1 (level)	black	yellow
5 OUT3 (temperature)	grey	grey
6 OUT4 (temperature)	pink	pink
7 not connected	lilac	blue

Connector 8-pole on connector 4-pole are available as accessories order no. E11228 (Y connection cable), order no. E11627 (T-Splitter box).



For safe function the sensor housing must be electrically connected to the vessel wall. To do so, use the housing connection (see scale drawing and a cable piece with a wire cross-section of min. 1.5 mm² that is as short as possible.

The unit conforms to the standard EN 6100-6-4. The unit may cause radio interference in domestic areas. If interference occur, the user must take appropriate remedial actions.

6 Programming

Use of pushbuttons

- The parameter names are scrolled with each pressing of the “Mode/Enter” button.
- When the “Set” button is pressed briefly, the corresponding parameter value is displayed for 15 s (the value is not changed, the internal sensing, processing and output functions of the unit continue as if in Run mode).
- While viewing a parameter value pressing the “Set” button for more than 5 s causes the unit to enter the programming mode. The current parameter value flashes for 5 s, then the value is increased.
*Decrease the value: Let the display of the parameter value move to the maximum setting value. Then the cycle starts again at the minimum setting value.

Timeout

If no pushbutton is pressed for 15 s during the programming procedure, the unit returns to the Run mode with unchanged values (exception: cOP).

Locking / Unlocking

The unit can be electronically locked to prevent unwanted adjustment of the set parameters: In the Run mode press programming buttons for 10 s. As soon as the indication goes out the unit is locked or unlocked.

Units are delivered from the factory in the unlocked state.

With the unit in the locked state **LOC** is indicated briefly when you try to change parameter values.

The sensor can be programmed before or after mounting.

Exception: For the adjustment of the reference element OP the unit must be installed in the tank.

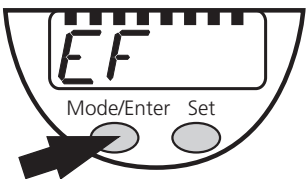
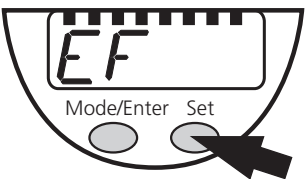
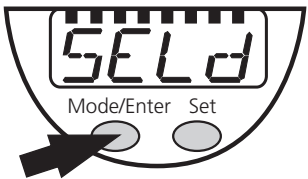
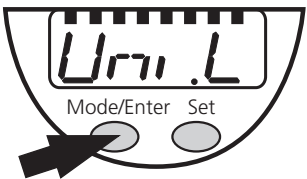
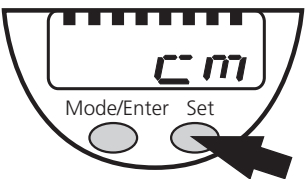
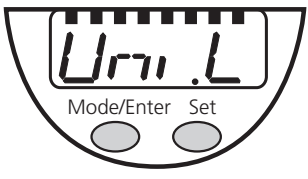
For programming carry out the following steps in the indicated order.

6.1 Selection of the display unit

Select the display units (cm / inch or °C / °F) before setting the values for the parameters for SPx, rPx, OP). This avoids rounding errors generated internally during the conversion of the units and enables exact setting of the values.

Setting at the factory: Uni.L = cm, Uni.T = °C.

If the factory setting is to be maintained, skip step 1 and continue with step 2.

		
Press until EF is displayed.	Press briefly.	
		
Press until Uni.L (display unit for level) is displayed.*	Press and hold until the requested unit (cm or inch) is indicated.	Confirm / return to the menu.

* Another press of the pushbutton “Mode/Enter” opens the menu point Uni.T (display unit for temperature). Set the requested unit (°C or °F).

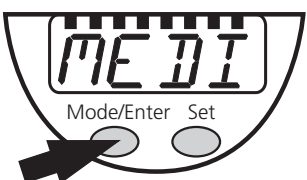
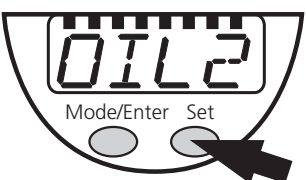
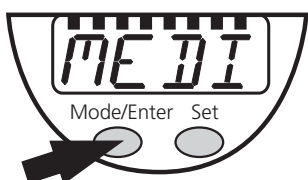
6.2 Setting to the medium

The sensitivity of the sensor can be set in 2 steps.

Medium	Setting	Sensitivity
Special (e.g. synthetic) oils or media with a dielectric constant that is a little higher than that of mineral oils*	OIL1	low
Mineral oils (dielectric constant ≈ 2)	OIL2	high

*Also select this setting if the medium is detected with OIL2 but on the whole the sensor sensitivity is too high.

In case of doubt ensure the correct function by performing a test in your application.

		
Press until MEDI is displayed.	Press and hold until the requested value is indicated.	Confirm / return to the menu.

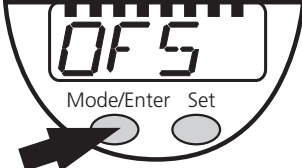
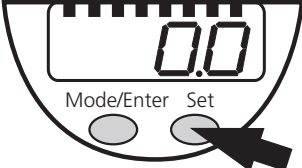
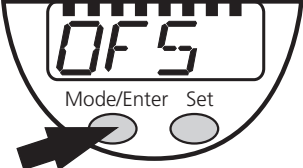
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6.3 Setting of the offset value

The zone between tank bottom and lower edge of the measuring probe can be entered as offset value (OFS). Thus display and switch points refer to the real level.

Note: Set OFS before setting the reference point OP and the switch points for level (SP1/2, rP1/2). This avoids inadvertent maladjustment.

Setting at the factory: OFS = 0.

		
Press until OFS is displayed.	Press and hold until the requested value is indicated.	Confirm / return to the menu.

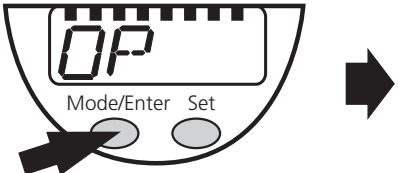
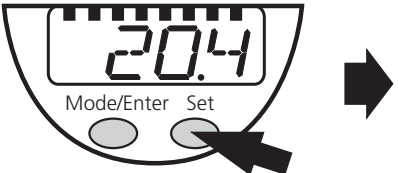
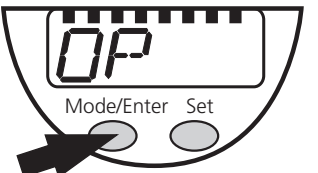
	LT8022		LT8023		LT8024	
	cm	inch	cm	inch	cm	inch
Setting range	0...78	0...30.8	0...57	0...22.4	0...186	0...73
Step increment	0.5	0.2	0.5	0.2	1	0.5

6.4 Setting of the switching parameters

OP	Reference point level Please observe the installation instructions and the indicated minimum distances, especially the distance between OP and the medium (→6.7). OP limits the measuring range at the upper end.
SP1...SP4	Switch point: upper limit value at which the operating output changes its switching status.
rP1...rP4	Reset point: lower limit value at which the operating output changes its switching status.
OU1...OU4	Switching function for the operating output: 4 settings can be selected: hysteresis (H..) or window function (F..), as normally open (.no) or normally closed (.nc).

SP1/2 and rP1/2 - limit values level

SP3/4 and rP3/4 - limit values temperature

		
Press until the requested parameter is displayed.	Press and hold until the requested value is indicated.	Confirm / return to the menu.

Set OP before setting the switch points for level (SP1/2, rP1/2). If the OP value is reduced to a value \leq SPx after switch point setting, the SPx values shift downward.

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The setting values for OP and the setting ranges for SPx and rPx are indicated in the following tables.

Please note: The setting values for OP and the setting ranges for SP1/2 and rP1/2 apply to OFS = 0; for OFS > 0 they increase by the set OFS value.

Setting values for OP

LT8022		LT8023		LT8024	
cm	inch	cm	inch	cm	inch
6.9	2.7	13.9	5.5	20	8.0
8.2	3.2	16.3	6.4	24	9.5
9.4	3.7	18.8	7.4	28	10.9
10.6	4.2	21.2	8.3	31	12.3
11.8	4.7	23.6	9.3	35	13.8
13.0	5.1	26.1	10.3	39	15.2
14.3	5.6	28.5	11.2	42	16.7
15.5	6.1	31.0	12.2	46	18.1
16.7	6.6	33.4	13.1	50	19.5
17.9	7.1	35.8	14.1	53	21.0
19.1	7.5	38.3	15.1	57	22.4
20.4	8.0	40.7	16.0	61	23.9

Setting range for SP1/2, rP1/2 (level)

	LT8022		LT8023		LT8024	
	cm	inch	cm	inch	cm	inch
SP1/2	2.5...20.0	1.0...7.8	4.0...39.5	1.6...15.6	6...59	2.5...23.0
rP1/2	2.0...19.5	0.8...7.6	3.5...39.0	1.4...15.4	5...58	2.0...22.5
ΔL^*	0.5	0.2	0.5	0.2	1	0.5

* ΔL = increments

- rPx is always smaller than SPx, SPx is always smaller than OP.
If the value for OP is reduced to a value \leq SPx, the position of SPx also shifts.
If the value for SPx is reduced to a value \leq rPx, the position of rPx also shifts.
- If rPx and SPx are close together (about 3 x step increment), rPx is changed automatically when SPx is increased.
- If there is a greater difference between rPx and SPx, rPx maintains the set value even if SPx is increased.

Setting range for SP3/4, rP3/4 (temperature)

	°C	°F
SP3/4	0.5...90	33...194
rP3/4	0.0...89.5	32...193
ΔT^*	0.5	1

* ΔT = increments

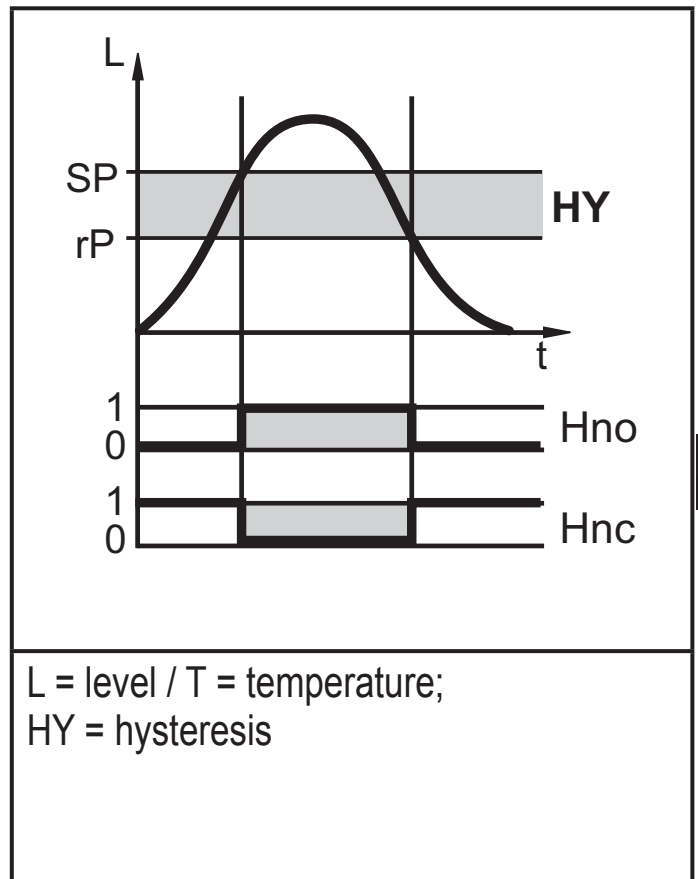
rPx is always smaller than SPx

Hysteresis function (Hno, Hnc):

The hysteresis keeps the switching state of the output stable if the level / temperature of the medium varies about the preset value.

With the level / temperature rising, the output switches when the switch-on point has been reached (SPx). With the level / temperature falling the output does not switch back until the switch-off point (rPx) has been reached.

The hysteresis can be adjusted: First the switch-on point is set, then the switch-off point with the requested distance.

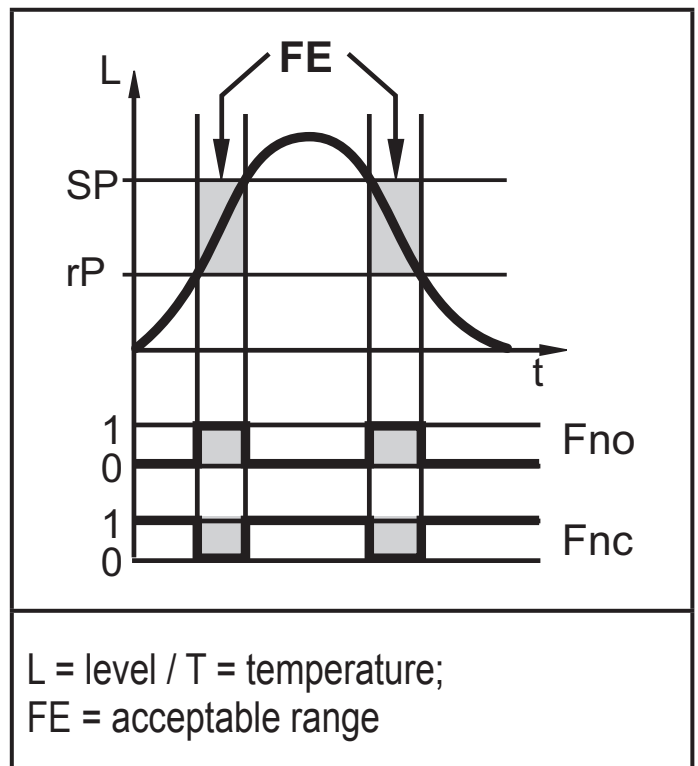


Window function (Fno, Fnc):

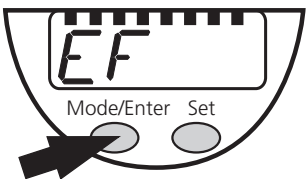
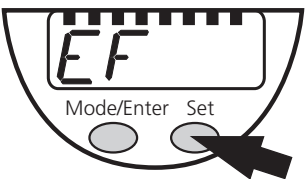
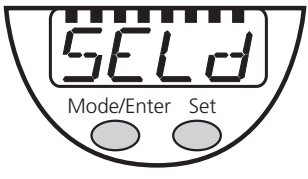
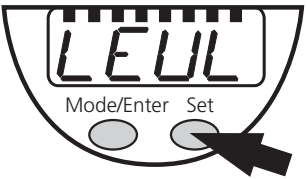
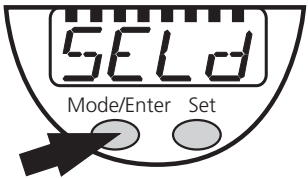
The window function enables the monitoring of a defined acceptable range.

When the level / temperature of the medium varies between the switch-on point (SPx) and the switch-off point (rPx), the output is switched (window function / NO) or not switched (window function / NC).

The width of the window can be set by means of the difference between SPx and rPx. SPx = upper value, rPx = lower value.



6.5 Selection of the displayed measuring unit

		
Press until EF is displayed.	Press briefly.	SELD is indicated.
		
Press and hold until the requested value is indicated.	Confirm / return to the menu.	

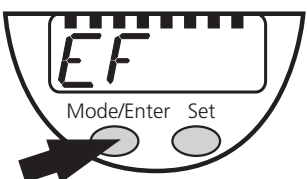
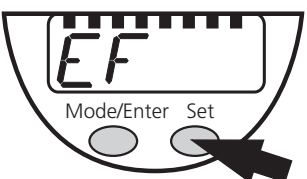
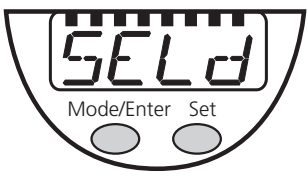
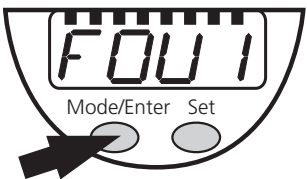
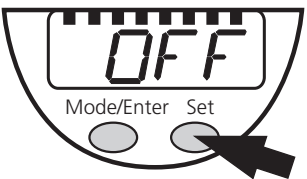
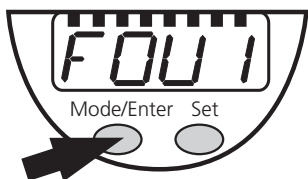
3 settings can be selected:

- LEVL = indication of the level.
- TEMP = indication of the temperature.

The measuring unit can be changed in the Run mode temporarily (briefly press the “Set” pushbutton).

- OFF = In the Run mode the display of the measured value is deactivated. If one of the buttons is pressed, the current measured value is displayed for 15 s.

6.6 Setting of the output response in case of a fault

		
Press until EF is displayed.	Press briefly.	
		
Press until FOU1* is displayed.	Press and hold until the requested value is indicated.	Confirm / return to the menu.

*FOU1 (FOU2 / FOU3 / FOU4) = response of output 1 (output 2 / output 3 / output 4) in case of a fault.

2 settings can be selected:

- On = output x switches ON in case of a fault.
- OFF = output x switches OFF in case of a fault.

Setting at the factory: FOU1 ... FOU4 = OFF.

A hardware fault or an adjustment error for example is considered to be a fault (→ 7.1).

Overflow is not considered to be a fault!

6.7 Adjustment of the reference element OP

After mounting, electrical connection and programming the unit must be adjusted to the tank. This is done by the OP adjustment.

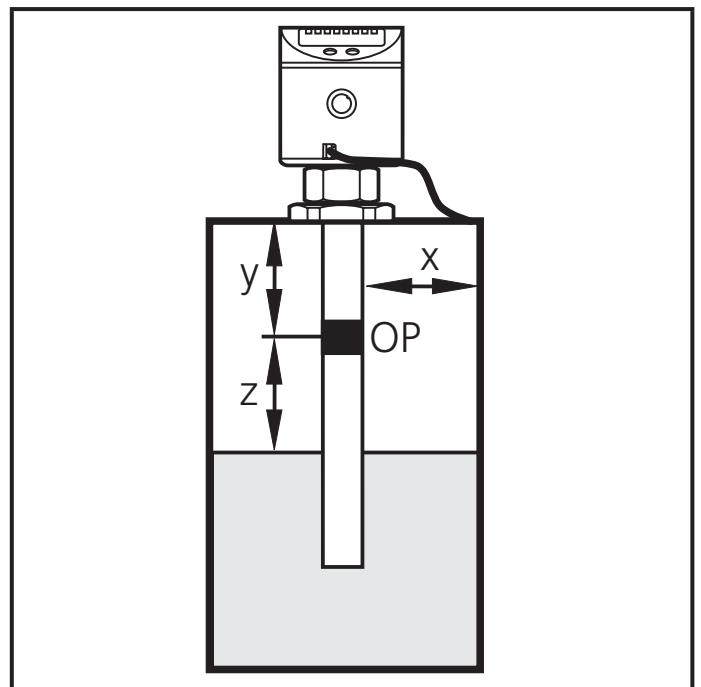


The monitoring functions for level are only active after this adjustment. If it is not carried out, only the functions for temperature indication and monitoring are active. Level indication and the switching outputs OUT1 and OUT2 remain blocked, the display indicates $\equiv \equiv \equiv \equiv$.

During the adjustment the OP segment must not be covered by the medium.

Minimum distance (z) between OP and medium:

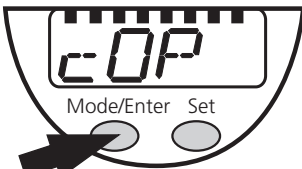
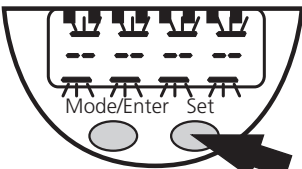
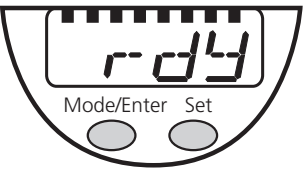
LT8022		LT8023		LT8024	
cm	inch	cm	inch	cm	inch
2.0	0.8	3.5	1.4	5.0	2.0



If the tank is very full, empty it a little or (if possible) increase the OP value.

Ensure that the minimum distances x and y are adhered to (→ chapter 4).

Adjustment operation:

		
<p>Press until cOP is displayed.</p>	<p>Press and hold until the display no longer flashes.</p>	<p>If adjustment is successful, rdy is indicated. Return to the menu by pressing a pushbutton.</p>

During the adjustment the unit checks the installation conditions by evaluating the measured signal generated by the OP element. If the measured signal is invalid (if for example the mounting situation is below the minimum distance), an error message is displayed (→ 7.1).



OP adjustment must be carried out each time when changing a sensitive parameter (setting to the medium, position of the overflow switch point). If the sensor detects relevant changes $\Xi\Xi\Xi\Xi$ is displayed.



If the mounting situation (height, position) or grounding (e.g. length of the earthing cable) is changed, it is also absolutely necessary to make a new OP adjustment to ensure a correct function of the overflow protection.
Caution: In this case empty adjustment is not required by the sensor by displaying $\Xi\Xi\Xi\Xi$!

7 Set-up / operation

After mounting, wiring and programming check whether the unit operates correctly

7.1 Operation and fault indication

CAL	Initialisation after power on.
XX.X	Level indication. Temperature indication.
- - - -	Level below the active zone.
FULL XX.X	Overflow protection point OP reached. "FULL" and the indication of the current level alternate every second (= warning overflow).
≡≡≡≡	Adjustment of the reference point OP required (→ 6.7).
UL	Measuring range temperature below the minimum value.
OL	Measuring range temperature exceeded.
Err0, Err2 Err7, Err8	Faults in the electronics (the unit must be replaced).
Err1	- OP segment dirty (clean the probe and carry out a reset). Or: - OP segment faulty (the unit must be replaced).
Err3	Operational reliability not ensured (sources of interference, faulty wiring). Check the electrical connection, the connection between the sensor and the tank ground (→ 5 Electrical connection), and the mounting conditions (→ 4 Installation).
Err4	Adjustment fault: distance between OP segment and the mounting elements or the medium too small.
Err5	Adjustment fault: mounting element below OP segment detected.
Err6	Adjustment fault: measured value not constant.
Err9	Temperature measuring element faulty (the unit must be replaced).
SC1, SC2, SC3, SC4	Flashing: short circuit in the switching output 1, 2, 3, 4.

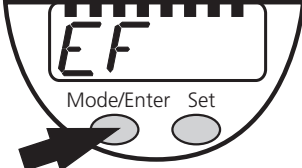
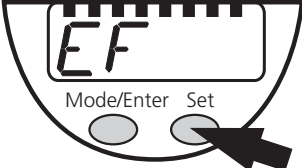
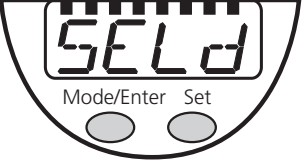
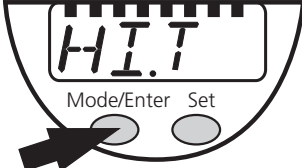
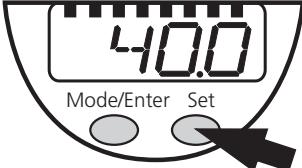
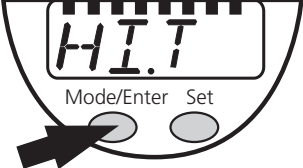
Resetting the error messages: carry out the OP adjustment again or power off and on again.

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7.2 Changeover between level and temperature indication

Briefly press the Set pushbutton in the Run mode. The other measured value is displayed for 15 s.

7.3 Read / reset maximum value memory temperature

		
Press until EF is displayed.	Press briefly.	
		
Press until HI.T is displayed.	Press briefly.	Return to the menu.

Erase the memory:

- Press the “Mode/Enter” button until “Hi.T” is displayed.
- Press the “Set” button and keep it pressed until “- - -” is displayed.
- Then press the “Mode/Enter” button briefly.

7.4 Read the set parameter values

- The parameter names are scrolled with each pressing of the “Mode/Enter” button.
- When the “Set” button is pressed briefly, the corresponding parameter value is displayed for 15 s.

7.5 Output response in different operating states

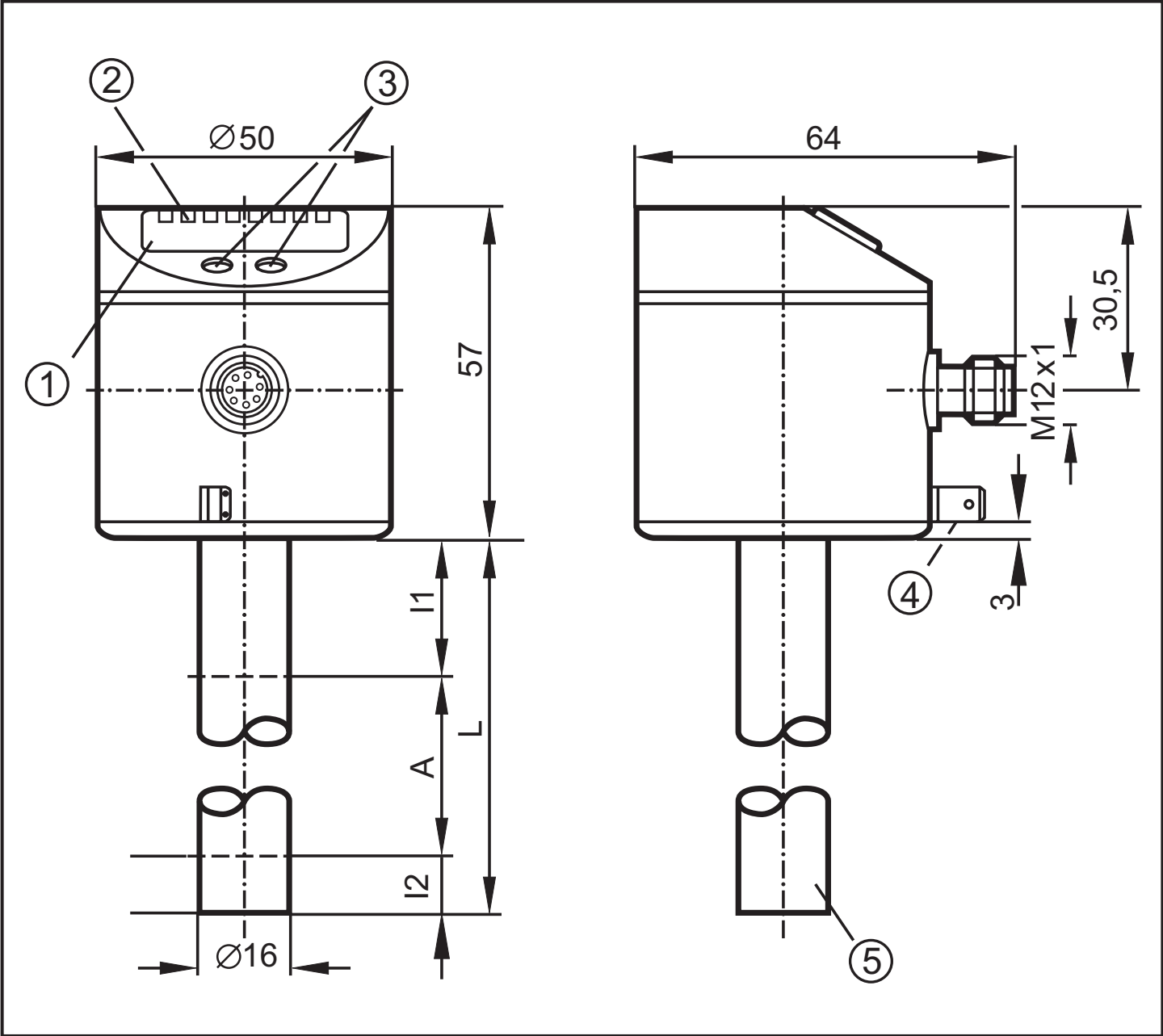
	OUT1 / OUT2 (level)	OUT3 / OUT4 (temperature)
Initialisation	OFF	OFF
OP adjustment not carried out	OFF	according to the temperature and OUT3 / OUT4 setting
OP adjustment carried out	according to the level and OUT1 / OUT2 setting	
Fault	according to the FOU1 / FOU2 setting	according to the FOU3 / FOU4 setting

8 Technical data

Operating voltage [V].....	18...30 DC
Current rating [mA]	200
Short-circuit protection, pulsed; protected against reverse polarity and overload	
Voltage drop [V]	< 2.5
Current consumption [mA].....	< 60
Level monitoring	
Accuracy of switch point [% of value of measuring range]	± 5
Repeatability [% of value of measuring range]	± 2
Max. speed of the level change [mm/s]	
- LT8022	100
- LT8023	200
- LT8024	300
Temperature monitoring	
Accuracy [K]	± 1
Resolution [K]	0,5
Dynamic response (T09) [s]	90 (DIN EN 60751)
Dielectric constant medium	> 2
Max. tank pressure [bar] (when mounted using ifm mounting accessories)	0.5
Housing materials.....	stainless steel; FKM; NBR; PBT; PC; PEI; PP; TPE-V
Materials (wetted parts).....	PP
Protection	IP 67, III
Operating temperature [°C]	0...60
Medium temperature oil	
- permanent [°C]	0...70
- peak [°C].....	0...90
Storage temperature [°C].....	-25...80
Shock resistance [g]	15 (DIN EN 60068-2-29, 11 ms)
Vibration resistance [g]	5 (DIN EN 60068-2-6, 10...2000 Hz)
EMC EN 61000-4-2 ESD:	4 / 8 kV
EN 61000-4-3 HF radiated:	10 V/m
EN 61000-4-4 Burst:	2 kV
EN 61000-4-4 Surge:	0.5 / 1 kV
EN 61000-4-6 HF conducted:	10 V

UK

9 Scale drawing



	LT8022		LT8023		LT8024	
	cm	inch	cm	inch	cm	inch
L (probe length)	26.4	10.4	47.2	18.6	72.8	28.7
A (active zone)	19.5	7.7	39.0	15.4	58.5	23.0
I1 (inactive zone 1)	5.3	2.0	5.3	2.0	10.2	4.0
I2 (inactive zone 2)	1.5	0.6	3.0	1.2	4.0	1.6
1	4-digit alphanumeric display					
2	status LEDs					
3	programming buttons					
4	housing connection (flat-pin connector 6.3 mm following DIN 46244)					
5	position of the temperature measuring element					